REMARKS

The Office Action of May 29, 2003 has been reviewed and carefully considered.

Independent claim 1 has been amended, and new independent claim 5 has been added to the application. Claims 1 through 5, as herein amended, are now pending.

Reconsideration of the above-identified application, as herein amended, is respectfully requested.

The present invention is intended to provide a solution to a specific problem, namely, the increasing occurrence of damage to the shaft bearings in modern converter-fed three-phase motors, which arises as a result of the high switching speeds of IGBT converters. This bearing damage is caused by high-frequency "bearing currents" that are induced to flow through the motor shaft, bearings and laminated stator core. The bearing currents are present because a high voltage gradient of the three-phase feed voltage with respect to ground induces a voltage in the motor shaft, which in turn results in capacitively coupled high frequency bearing currents that flow through the bearings and motor housing. Applicant provides an advantageous and heretofore unknown structural arrangement for solving this problem by significantly minimizing, if not substantially eliminating, these destructive bearing currents.

Applicant does not contend that it is the first to recognize or appreciate the presence or the damaging effects of bearing currents, or to provide an apparent solution -- or at least an effort to reduce these bearing currents and their destructive consequences. Indeed, Bell, he named inventor in the Examiner-cited U.S. Patent No. 6,202,285, expressly points out in his specification that "The prior art has provided electrostatic shield arrangements to reduce capacitive coupling between the rotor and stator, and consequent current discharge through the bearing assemblies." (Col. 1, ll. 28-31). Bell then goes on to propose his own "solution" to this problem, which the U.S.

Patent and Trademark Office apparently deemed sufficiently different from those theretofore known to award Mr. Bell a U.S. patent.

Applicant's solution is likewise different from that taught by Bell or, indeed, from any other such prior art teachings known to applicant. Applicant's solution to the bearing current problem is, as applicant respectfully contends, itself is properly patentable over the prior art teachings.

In the Office Action, the Examiner has rejected previously-presented claims 1 to 4 under 35 U.S.C. §103(a) as allegedly unpatentable over the combination of Shioda, et al., Snider et al., and Bell. The Examiner states that "Shioda teaches every aspect of the invention except the coil grounded only on the current fed side of the winding and a shaft supported by bearings." The Examiner further states that Snider teaches "the stator grounded on the same side as the stator windings and a motor shaft 30." Finally, the Examiner cites Bell for its teaching of "a motor with a shaft supported by bearings where the coils are shielded to prevent bearing breakdown." From this, the Examiner then contends that "It would have been obvious to a person of ordinary skill in the art at the time of the invention to construct the motor of Shioda with a winding shield grounded on the same side as the stator terminals to simplify electrical connections to the motor as in Snider, and with the shaft of Shioda to provide rotary output from the machine, and with the coils insulation being grounded to prevent bearing breakdown, as taught by Bell."

As pointed out below, the Examiner's proferred combination of modified and substituted elements can logically result only from an attempted hindsight reconstruction of applicant's invention, with the Examiner picking and choosing disparate pieces from one or another of the cited reference in an effort to attain applicant's claimed invention. That effort, however, is doomed to fail as being improperly constructed as a matter of law and for failing as a matter of fact,

even assuming *arguendo* the propriety of making the asserted combination, to teach applicant's claimed invention.

The newly-cited Bell patent, as noted above, does indeed attempt to solve the same problem to which the present invention is directed -- namely, reducing bearing currents that cause damage to motor bearings. Thus, Bell's invention is *functionally* similar to applicant's invention. And Bell seeks to solve this problem in a manner similar, though still in fact different in its essential details, than that utilized by applicant herein -- namely, by providing an electrostatic shield arrangement. But what must be recognized is that Bell's "solution" is notably different from that of the present invention, as set forth in applicant's claims, in several fundamental ways.

First, Bell teaches that "To reduce capacitive coupling, the present invention provides an electrostatic shield arrangement, indicated generally at 43, *interposed between rotor 40 and the conductive windings of stator 30.*" (Emphasis supplied)

The "electrostatic shield" of Bell, which includes a conductive layer 52 that "is applied to insulative layer 50 radially inward thereof (i.e. toward shaft 12)", is thus located *between the rotor 40* (which is fixed to and rotates with the motor shaft) *and the conductive windings of the stator*. In the present invention, on the other hand, and as expressly recited in the claims, the electrically conductive layer is arranged or disposed *between the stator winding and the laminated stator core*. Thus, the conductive layer of Bell is located between the winding and the *motor shaft rotor*, whereas the conductive layer of the present invention is located between the winding and the *stator core*. This important difference is not one of mere mechanical choice, but, rather, is firmly indicative of the different ways in which Bell and applicant herein have approached and provided their respective "solutions" to the same problem.

In addition, Bell expressly teaches that the manner and details by which his conductive layer is electrically connected to ground is unimportant to his arrangement and his "solution" to the bearing current problem. Thus, Bell states that "Preferably, conductive layer 52 will be in electrical communication with core 32, such as by contact with the inside walls of the slots 44. As a result, conductive layer 52 will be desirably grounded." (Col. 5, ll. 1-4). In applicant's claimed invention, on the other hand, the electrical connection of the conducting layer to ground "only on the current fed side of the winding" is an essential, expressly recited part of applicant's claimed invention. As is explained in applicant's specification, it is as a consequence of this specific manner of electrical connection of the conductive layer to ground, in combination with the location and arrangement of the conductive layer in applicant's invention between the winding and the stator's laminated core, that results in the advantageous operative behavior of applicant's claimed construction.

As a consequence, the only relevant thing that can be said of the cited Bell reference is that it demonstrates an awareness in the prior art of the same problem to which applicant's invention is directed, and that it teaches a purported "solution", albeit a "solution" that is structurally and notably different from that provided by applicant herein. Since neither of the other two pieces of cited prior rat -- Shioda and Snider -- contain any mention or reference whatsoever to "bearing currents" or of the damage to bearings caused by such bearing currents, absent hindsight reconstruction there would be no reason for the person of skill to consult Bell to remedy any perceived deficiencies in Shioda or Snider or to combine any teachings from Bell with the teachings of those other two cited references.

As also noted above, the Snider patent has been cited by the Examiner for its teaching of a "stator grounded on the same side as the stator windings and a motor shaft 30." Here,

again, this "teaching" has absolutely no relevance to the problem tackled by the present invention or to the teachings of Shioda. Snider discloses a motor construction and manufacturing method provided to enable automated assembly of a particular type of motor and thereby reduce the costs of the device. Snider note that "...because the motor is lead-less, and intended for application by original equipment manufacturers' personnel, the receptacle must be designed for foolproof installation of the power leads for the motor." (Col. 1, ll. 51-55) The manufacturing method and construction taught by Snider is thus only applicable to a particular type of motor for specific applications, and is neither applicable, nor relevant, nor useful to a motor designer attempting to solve the problem of circulating bearing currents in an existing motor. Moreover, while it is true that, in the motor construction of Snider, the "ground terminal" 20 is located adjacently interposed between the current-carrying terminals 12 and, therefore, on the "same side" as their connections to the stator winding, that "ground terminal" is simply connected to the stator assembly core 7 (see Col. 4, ll. 15-19 of Snider). The motor of Snider does not include a conductive layer -- whether one disposed (as in the present invention) between the winding and the laminated core, or at any other location -- and there is therefore correspondingly in the motor of Snider *no connection* between such a conductive layer and ground "only on the current fed side of the winding" (as is expressly recited in applicant's claims). Here, again, only with impermissible hindsight reconstruction would one even consider the use of this alleged "teaching" in Snider to remedy an acknowledged omission in the Shioda reference.

Finally, with respect to Shioda, many of the essential difference between the teachings of that reference and the present invention have heretofore been discussed at some length -- see, for example, the discussion in applicant's prior Amendment mailed to the USPTO on April 24, 2002, which discussion is expressly incorporated herein by reference. Shioda fails to teach or

suggest the novel combination and arrangement of elements that applicant recites in the claims of the instant application and, moreover, is totally silent and has nothing whatsoever to do with efforts to solve the problem of bearing destruction from induced bearing currents.

Moreover, a careful reading of Shioda reveals that its disclosed construction and teachings have no utility in seeking a solution to the problem to which the present invention is directed. In implementing the present invention, a very low impedance (i.e. low resistivity) conducting shield and a low resistivity connection between the shield and the iron stator are vital to the elimination of capacitive currents. In modern inverter-driven motors, the peak circulating currents commonly reach levels of 90 Amperes or more, which requires that the conductive winding shield be constructed of copper or some other material which provides a very low impedance path for these induced currents.

Shioda, however, is quite specific in its teaching of a semi-electroconductive layer which has stated a resisitivity of between 10^2 and 10^5 Ohms, i.e. an absolute minimum resistivity of about 100 Ohms. Shioda also teaches an electroconductive rubber ring at one or both ends of the winding as the disclosed arrangement for connecting the semi-conductive layer and the iron stator core. Shioda specifies that this ring-shaped connector similarly has a resistivity of between 10^2 and 10^3 OHMS, i.e. once again an absolute minimum resistivity of about 100 Ohms.

The specified resistivity of the shield layer is itself sufficient to render the Shioda teachings useless as an arrangement for eliminating the high frequency capacitive currents to which the present invention provides an advantageous solution. Moreover, when the Shioda-specified resistivity of the electroconductive rubber connector is combined with the specified resistivity of the shield layer, any possible beneficial effect is wholly eliminated.

A simple application of Ohms' laws demonstrates that a current of 90 Amperes can only flow through a conductor with a minimum resistance of 200 Ohms if a driving voltage of 200 x 90 = 1800 volts is available; but a voltage of this magnitude is clearly not available in such motors. The peak power loss in such a circuit would then be 90^2 x 200 Watts, or approximately 1.6 x 10^6 Watts -- enough power to supply a small town -- which is intuitively nonsensical.

Shioda also teaches a resin-nonadhesive wire as a means of connecting the shield to the iron core. Such a wire would have an extremely high impedance at high frequencies and would not be effective in conducting high frequency capacitive currents away from the shield, even if the shield were itself capable of carrying those currents in the first place, which (as pointed out above) it is not. In addition, a conductive ring placed at both ends of the winding, as taught by Shioda, would eliminate any benefit with respect to minimizing of circulating currents, thus further rendering the teachings of Shioda absolutely useless in connection with the specific problem to which the present invention is directed.

Thus, the cited Shioda reference provides an assembly that itself cannot be used in its current form, or unless so extensively modified to in effect construct an entirely new and different device, to provide a solution to the precise problem tackled by the present invention. The person of skill would accordingly find no benefit from following the Shioda teachings, assuming *argundo* that the person of skill were to consult Shioda in seeking a solution to the same problem tackled by applicant herein.

Neither is there any teaching, suggestion or motivation in Shioda, or in any of the other cited art, for combining those various prior art references and/or for making the substitutions of elements proposed by the Examiner, absent impermissible hindsight reconstruction.

Independent claim 1 has been amended to set forth the inventive subject matter is a further clarified manner that is believed to still more readily indicate the differences between the invention and the cited prior art. New independent claim 5 restates the inventive subject matter in a "Jepson" format. No new matter has been added by these amendments to the claims.

For the foregoing reasons, applicant submits that claims 1 to 5, as now pending in the application, define patentable subject matter over the prior art, and their allowance is once more solicited.

Respectfully submitted,

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Dated: December 1, 2003